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R. H. STINCHFIELD, *Editor*

Editorial Office: 1102 16th Street, N. W., Washington 6, D. C.

VOLUME XXXVI NO. 7

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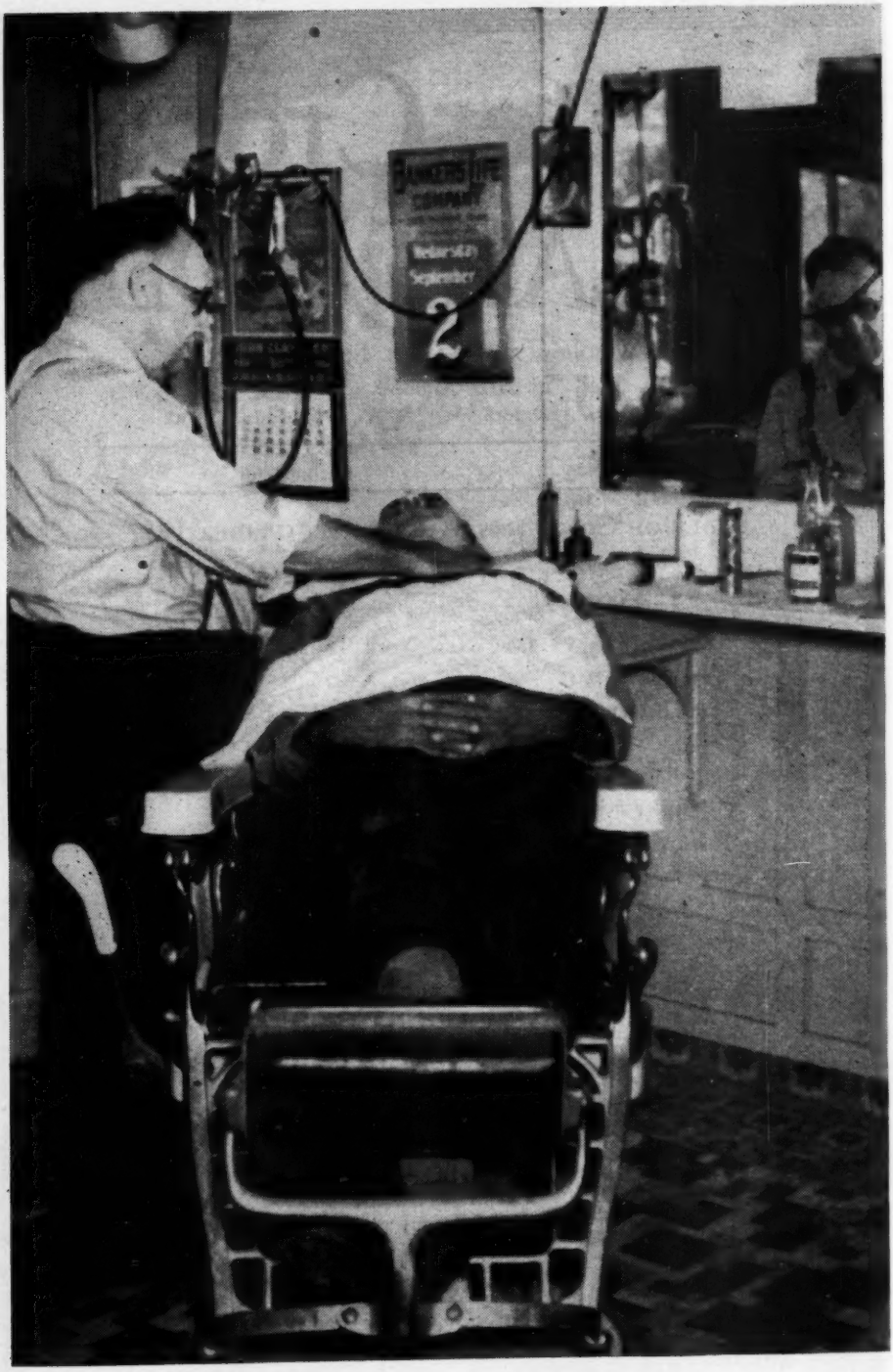

Sprucing Up for the Fair

Better Crops with PLANT FOOD

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Vol. XXXVI WASHINGTON, D. C., AUGUST–SEPTEMBER 1952 No. 7

Advantages when . . .

It's in the Bag

Jeff McDermid

BEING a devotee of the feed bag myself and a deep ponderer on proteins and other essentials discovered in recent decades for the rehabilitation of ruminants, it is hard for me to avoid serious speculaton and cogitation in the field of feeding livestock. The very fact that nobody is going to quote me as a ready reference or an established authority removes any shred of hesitation that remains. In other words, the fan who watches the ball game is able to shout advice without having any of it followed.

I've often wondered how much livestock themselves realize and fully appreciate how carefully and scientifically they and their inwards are being nutritionally analyzed, and how much they owe their success in life and reproduction to the host of high-toned caterers we now have in the ration-building business. Sometimes it seems that babies of the human family get less scientific attention paid to their balanced diet than do our calves, pigs, lambs, and chickens—and to a less degree, the vanishing farm colt.

We see few diagrams of self-feeders for infants, or creep feeding and growing mashes applied to the spring kid crop, while the amount of display advertising in farm journals devoted to calf meals, chick starters, and the like, amounts to considerably more than all the paid space dedicated to human juvenile regeneration. I've often wondered if the dodo and the auk, the phoenix bird, the dragon, the unicorn and the winged bull would still be with us if the ancients had treated them right at mealtimes.

Investigations in animal feeding have bred furbelows and fancies which fol-

lowed in the wake of alleged new discoveries, most of which just uncovered the causes and reasons behind good livestock menus without adding any items not previously existing in nature. In this way some seemingly zaney ideas get temporary attention. I recall the sawdust supplement mixture for dairy cows we heard broached 25 years ago, and the more recent trial balloon about using soap substitutes (detergents) in the pig fodder. It's a wild, free-for-all game with no brake on the resolute reliance upon native enterprise we like to promote. This system often leads to using a molehill of science in a mountain of management.

NEW fads and fresh laboratory findings are seized upon and plugged for all they and the livestock will stand —and for a while some extreme hustlers for business have even claimed they can cook up mixtures and nostrums which will cure brucellosis, foot-and-mouth disease, anthrax, and vesicular exanthema. Naturally some of the bona fide feed promoters won't touch these half-baked and weird combinations, and the laboratory savants frown on quick-money claims raised from unfinished theories.

In some ways an animal on the farm is better off, and in other ways worse off, than the adult member of the genus homo in his right mind. When it comes to eating, about all the dumb animal can tell a feeder is through his appetite—good, bad, and indifferent. But because grazing cattle will often eat plants and mixtures that are afterwards bad for their systems, we can't always claim that livestock digestion waits on appetite and health on both—as Shakespeare measured the human diet.

Folks around us often differ in the way they take to certain foods and stubbornly get grouches and sit-down strikes against perfectly good, well-seasoned, and healthful grub which the rest of us devour rapidly. Good mothers get gray over such refusals. That's where having a so-called mind, which animals are said to lack, comes into the picture. So maybe the stockman is lucky that his critters don't mix so much gray matter with their menus. As long as they are hungry and the stuff doesn't taste too awful, they will ingest almost any old combination handy. They fail to detect the difference between rations which are alike in flavor and palatability, but widely unlike in actual nutrition and cost. And they don't care a hoot, either. So that's where the feeder steps in and takes over —to do their thinking and choosing for them.

HENCE the domestic farm animal grown for profit has to take the word and the judgment of the feeder or his friend, the faddist. But the human gourmet chooses for himself more or less at mealtime, and is often governed more by food expense than food efficiency. In these days of supersalesmen I'm not so sure that either the calf at the rack or the guy at the dinner table can be said to have the best of it. Unfortunately, the test of longevity or life expectancy doesn't apply to the measurement of rations for quadrupeds, except for the dairy cow in training for a lifetime milk record.

That's because the better the ration for the farm critter, the sooner it gives up the ghost, whereas the general idea in human metabolism is usually quite the opposite. With most livestock the goal is that the better the feed the less you'll have to feed in the long run. Fattening livestock obligingly adopt that same theory and thereby lend their short lives to the profit and the plenty of mankind.

And then, of course, as a rule man won't eat grass. True, he takes to some packaged diets that closely resemble well-cured hay, and he has been hearkening of late to the "chlorophyll" craze. Out in the West last month somebody dared to take a fling at the extreme application of this breath-taking theory by this couplet: "The goat that reeks on yonder hill has browsed all day on chlorophyll." We may look

in vain among the official annals of the International Grasslands Congress for any further development of that idea in human nutrition and sanitary digestion, although there will be plenty of it served up for animal welfare.

Your dutiful scribe is not entirely without experience in the art of balanc-

ing rations. Some years ago as a farm journal handyman it fell to my happy lot to do for the customers odd jobs which the boss editor disdained. One of these vital tasks was to try and balance livestock rations for some unknown distant farmer. He usually had marsh hay or timothy, a little rough corn stover and fodder, maybe a little excelsior out of a packing case, oat hulls galore, No. 5 barley somewhat discolored and musty, a binfull of soft corn, and a hard heart. No mention was made in those carefree days of green pastures, either in summer or winter. It was a tabooed topic. Pasture was like forests and fishing—just an act of nature volunteering on a place good for nothing else. You merely stepped in during favorable times and made the most of it.

You'd have wheat bran, middlings, linseed meal, cottonseed meal, corn gluten feed, distillers dried grains, maybe some brewery malt, and similar standard supplements to fling at him by return mail. You'd also advise him to buy some choice alfalfa hay and build himself a silo. This era was just prior to the vitamin and minerals feeding period, which was the real dawn of the professional feed salesman. There was no brand on the bran in earlier times and no label on the linseed. It "ain't so" now.

But the son of that same coarse-roughage-carbohydrate-feeding farmer is now caught up in a more complex situation. He can't look his critters in the face unless he keeps hep to the latest feed bag philosophy. Yet in many ways his task is easier than his dad's, provided he follows the custom of making good hay, pasture, and silage the foundation of his ration reckoning. Moreover, perhaps a major share of the perplexed farm feeders now rely upon ready-mixed rations, most of which were regarded with doubt and classed with commercial fertilizers in the early days of this century—as materials which were more expensive than useful. Thus farm attitudes have much to do with farm achievement, but on the other hand, educated farmers are smarter, more discriminating, and less easily cajoled.

EVEN the lowly farmyard fowl has been the beneficiary of much studious solicitude from nutrition balancers. When we used to raise chickens from their maternal nest to the wishbone windup, all we ever fed them of value was cracked corn. Everything else was pure salvage. But by the year 1950, I am told, a poultry ration expert could drink his eggnog and reflect that all the dietary requirements of poultry had been thoroughly defined on the menu map. Somewhere near 40 separate essential ingredients had been charted.

But once more the field of inquiry widens. The nomenclature and the jargon are fast leaving the average sand hill chicken man gaping with surprise and dazed with dilemma. The queer thing about this growing encyclopedia of the chicken caterer is that poultry often grow to ripe maturity and hatch out lively offspring without con-

(*Turn to page* 42)

Fertilizers Used in 1951 By New York Tomato Growers

By M. T. Vittum

Department of Vegetable Crops, Cornell University, Ithaca, New York

IN 1951, the Department of Agricultural Economics at Cornell University obtained cost and return-per-acre data from canning-factory tomatoes grown on 24 individual New York farms. In this survey, accurate records of all of the various costs involved in producing tomatoes were secured, but the present discussion is limited to an analysis of the fertilizer practices followed on these farms.[1]

[1] The data on fertilizer practices were kindly supplied by Professor C. D. Kearl of the Department of Agricultural Economics, Cornell University, Ithaca, New York.

The 24 growers produced a total of 665.3 acres of tomatoes, which was approximately 3.3 per cent of the 20,000 acres of cannery tomatoes grown in New York in 1951. Individual acreages varied from 5.0 to 102.0, with an average of 27.7 acres per farm.

The 24 growers used a total of 17 different fertilizer mixtures or materials (Table I). Nine of these were complete fertilizers, four were superphosphate, potash, or phosphate-potash mixtures, three were nitrogen carriers, while the last was completely soluble starter solu-

TABLE I.—FERTILIZERS USED BY 24 TOMATO GROWERS IN 1951

Fertilizer grade or material	Number of growers using this material	Pounds applied by 24 growers			
		Fertilizer material	N	P_2O_5	K_2O
5–10–10	15	380,090	19,004	38,009	38,009
5–10–5	1	265,200	13,260	26,520	13,260
6–18–6	7	148,700	8,922	26,766	8,922
0–20–0	10	114,300	.....	22,860	.....
10–10–10	1	45,000	4,500	4,500	4,500
0–20–20	3	33,000	.....	6,600	6,600
8–16–16	2	17,750	1,420	2,840	2,840
6–12–12	1	12,000	720	1,440	1,440
4–14–6	1	12,000	480	1,680	720
4–12–8	1	9,200	368	1,104	736
0–14–14	1	6,000	.....	840	840
10–6–4	1	2,800	280	168	112
Ammonium nitrate	3	5,400	1,809	.....	.....
Nitrate of soda	1	4,100	656	.....	.....
Cyanamid	1	2,000	420	.....	.....
15–30–14 starter	13	3,814	572	1,144	534
Muriate of potash	1	1,300	.....	.....	780
Total	.....	1,962,654	52,411	134,471	79,293
Av. per acre	.....	1,597	79	202	119

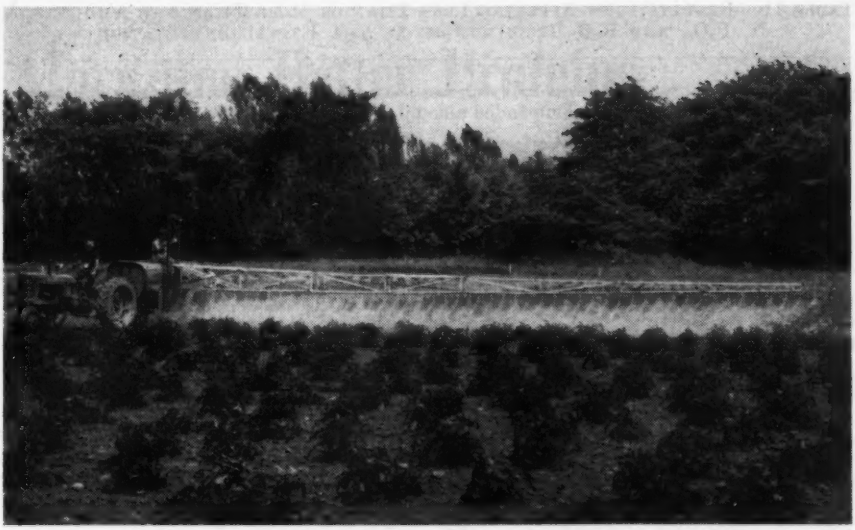

Fig. 1. An adequate program for control of anthracnose and early and late blights is essential for maximum production of canning tomatoes in New York. This sprayer with 50-foot boom is used to spray experimental plots.

tion used in the transplanting water.

The 665.3 acres received a total of 1,062,654 pounds of fertilizer, or an average of 1,597 pounds per acre. Although this sounds like a large amount of fertilizer, the average analysis was only 4.9-12.7-7.5, so that the average amounts of nitrogen, phosphate, and potash applied per acre were 79 pounds, 202, and 119 pounds, respectively. Present Experiment Station recommendations call for 600 to 1,000 pounds of 8-16-16 (or in certain cases 8-16-8) per acre, depending upon soil type and past fertilizer and cropping practices, plus a sidedressing of 200 pounds of nitrate of soda or its equivalent. Using the maximum recommendation, each acre would receive 112, 160, and 160 pounds, respectively, of N, P_2O_5, and K_2O. It is thus apparent that on the average, the 24 growers failed by 33 pounds of nitrogen and 41 pounds of potash in applying the amounts recommended by the Experiment Station, while at the same time they exceeded the phosphate recommendation by an average of 42 pounds per acre.

When the individual farms are divided into two classes, those exceeding the State recommendation and those applying less than the recommended amounts, the interesting data summarized in Table II are obtained. For nitrogen, for example, 20 of the 24 growers applied less than 112 pounds per acre, and these men averaged 17.5 tons of tomatoes per acre. The other 4 growers, who applied more than 112 pounds of nitrogen per acre averaged 20.7 tons of tomatoes, or a net gain of 3.2 tons per acre. Similar results were obtained for phosphate and potash—differences of 2.5 and 4.4 tons per acre, respectively, in favor of the growers using more than the recommended amounts.

Although results obtained from only 24 growers cannot be called conclusive, they certainly suggest that growers applying at least the amount of plant nutrients recommended by the Experiment Station will obtain larger yields than those applying amounts less than those recommended. Furthermore, it is important to note that the 24 growers covered by the 1951 survey are some of the best in the State. The average yield on the 24 farms, for example, was

TABLE II.—RESULTS FROM APPLYING LESS THAN OR MORE THAN THE AMOUNTS OF N, P_2O_5, AND K_2O RECOMMENDED BY THE EXPERIMENT STATION

Plant nutrient	Growers applying less than recommended amount			Growers applying more than recommended amount		
	No. of growers	Average acre application (lbs.)[1]	Average acre yield (tons)	No. of growers	Average acre application (lbs.)[1]	Average acre yield (tons)
Nitrogen (N).....	20	59	17.5	4	143	20.7
Phosphorus (P_2O_5)..	9	130	16.5	15	253	19.0
Potash (K_2O).....	19	98	17.1	5	223	21.5

[1] Recommended amounts are 112, 160 and 160 pounds per acre, respectively, of N, P_2O_5, and K_2O.

18.6 tons per acre, while the State average for 1951 was only 9.5 tons. In other words, if differences of 2 to 4 tons per acre were obtained on the best farms, considerably larger differences in favor of more fertilizer would be expected on farms of average or below-average productivity.

Starter Solution

It is interesting to note that although there is considerable evidence from New York and other tomato-producing states that it always pays to use a completely soluble N-P_2O_5-K_2O starter solution at transplanting time, only 13 of the 24 growers surveyed in 1951 used such a solution (Table I). It is well recognized that starter solutions not only reduce the loss of transplants but they also stimulate earlier maturity, and they increase total yield provided adequate reserves of plant nutrients are available in the soil to carry the crop through to maturity. Thus it is obvious that the 11 growers who did not use starter solutions in 1951 lost many tons of tomatoes from failure to adopt this practice.

Higher Analyses

For several years the Experiment Stations at both Geneva and Ithaca have recommended higher analysis fertilizers for vegetable canning crops. The data of Table III indicate that some progress has been made in this direction, although there is room for considerable improvement. Including only the 9 complete N-P-K fertilizers, it is evident that 25 per cent of the total fertilizer tonnage contained 30 or more units per ton, 45 per cent was composed of grades containing 24 or 25 units, while the remaining 30 per cent contained only 20 units per ton. This last category would have been

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TABLE III.—SUMMARY OF HIGH, MEDIUM, AND LOW ANALYSIS GRADES USED BY 24 NEW YORK TOMATO GROWERS IN 1951

Units per ton	Analysis	Pounds used	Per cent of total
30 or above	6–18–6, 10–10–10, 8–16–16, 6–12–12.....	223,450	25.0
24 or 25	5–10–10, 4–14–6, 4–12–8.....	401,290	45.0
20	5–10–5, 10–6–4.....	268,000	30.0
	Total.....	892,740	100.0

More and Better Proteins Make Better Food and Feed

By Wm. A. Albrecht

Department of Soils, University of Missouri, Columbia, Missouri

WHILE many phases of properly feeding ourselves may be subject to debate, no one has yet been found who will defend the negative of the proposition that "Man must eat if he is to live." Just what and how much we must eat are subjects still widely discussed.

As to what we must eat, most of us are agreed that our food must give us carbohydrates, fats, proteins, vitamins, and inorganic elements. Interest in food more specifically now running high both in the economics of the market place and in the research in the laboratory has recently pointed up the proteins as a problem case. This is, in its broader analysis, not a problem of rolling back the meat prices. Rather it is one of agricultural production. As a production problem, it is not one of more areas or of only more acres for food production. Instead, it is one of more productive quality there, namely, more completely balanced fertility of the soil with food production for complete nutrition and maximum of good health as the objective.

Nutrition of any life form is an integration, not an addition, of the separate factors, including the soil fertility.

The carbohydrates and the fats, giving us energy when they are burned in the body, have not been much of a food problem. Any growing plant makes its growth in a major way by the creation of carbohydrates. These pile up rapidly as vegetative bulk. They pile up rapidly on their conversion into fats. Also the carbohydrates preserve themselves readily. Fats do so a bit less readily. As to the particular chemical formulae of these two fuel-food components required by our bodies—or by any other life forms—there seems to be little limitation for the carbohydrates. Most any chemical structure of them seems to serve equally well, so far as we now know. In the case of the fats, however, there are to date at least three of specific chemical structures, which are specific body needs. These two food compounds are so readily produced, however, that they have been the more common food surpluses. In fact, they are surpluses so commonly that they are taken for granted in balancing our own diets or the rations for farm animals, and the provision not of them but of the proteins to supplement them has long been the problem. Unfortunately, the real origin of that problem of finding proteins enough to balance the carbohydrates and fats has not been traced far enough to discover that it lies in the fertility of the soil.

In the case of the proteins, the vitamins, and the inorganic elements—the last of which is usually called the "minerals"—these three essential food groups are very intricately interrelated. They are not so clearly separated as their group listing would lead one to believe. The inorganic elements supplied by the soil contribute to the effective functioning by the other two

much more specifically than is indicated by the extremely small or trace amounts we have been measuring in the ash contents of plant and animal tissues. The inorganic elements are often parts of the enzymes, i.e., of those agents which speed up biochemical reactions, and which usually contain also some vitamin-like and some protein-like compounds as their structural parts. The soil-borne, inorganic essentials seem to play important roles also in the plant's creation of the many vitamins about which we have recently learned much. The inorganic thus becomes a major part in the triumvirate of proteins, vitamins, and minerals, for plant growth.

The vitamins operate through enzyme systems, the other component parts of which are generally one or more minerals and certain specific proteins (1).* The inorganics, or the minerals, play a major role also in determining, by their presence and their proportions in the soil, whether our crops make more and better proteins in the plants or make just a little more than carbohydrates. When parts of the proteins are precursors for the body's formulation of some of the vitamins, and when the soil minerals connect the vitamins and proteins in our plants and ourselves to make possible all the enzymic biochemistry, it seems obvious that any imbalance or inadequacy of minerals coming from the soil (or of proteins and of vitamins present) would have a very causal connection with good (or poor) nutrition.

Unlike the carbohydrates and the fats, but more like the vitamins and the minerals, the proteins are required in the nutrition of man and animals as specific chemical structures. None of these will substitute for any of the others. As for the proteins, the body demands them as certain very specific chemical arrangements of the constituent elements. While the list of vitamins—still growing as a set of specific chemical structures—is a recent matter of the last 20 years, the known 22 amino acids composing the proteins represent evolutionary knowledge extending over a half century. Ten of these are specifically required for the survival of the white laboratory rat. Eight are absolutely essential for man if he is to live (2). It is the provision of these specific parts of the proteins, more than of merely compounds carrying nitrogen, that has probably become the major part in our struggle for good nutrition.

Proteins have become a problem of their creation in agricultural production. It is a problem of their creation, not only in the form of meat, milk, and eggs which are in reality only conjugations from the proteins which the animals merely collected in their feeds, but also in the form of all the specific amino acids that must be synthesized by the plants—and the microbes in the soil or in the animal's digestive tracts —and then, by these only according as the inorganic elements and the organic compounds contributed by the soil for plant nutrition will permit. Proteins can be propped up in either quantity or quality only by soils more fertile in terms of both the inorganic and the organic respects, many known and possibly unknown. It is to this significant fact connected with the soil that the declining protein production by our crops ought to be calling our attention more universally.

Provision of crude proteins appears to be a problem of guaranteeing the supply of the specific amino acids needed by plants for their nutrition and through that for nutrition of ourselves and our animals.

Just how plants make proteins is still one of Nature's mysteries. We have given little thought to the possibility that plants are struggling to *make* their necessary proteins just as animals are ranging far and wide to *collect* theirs, nor have we thought that healthy man must be highly omnivorous and

* Numbers in parentheses refer to literature cited.

that all of these are efforts to make certain that each form of life is getting the complete list of the required amino acids. Only recently have we become concerned about *feeding* our crops in place of merely *turning them out* at seeding time to *rustle for themselves* until "rounded up" at harvest time.

We have not yet thought about the need to help legumes make a particular protein in the form of a specific combination of certain amino acids. We have talked much about "lime for legumes" so they can use soil bacteria to take nitrogen from the air to make their proteins. We are now using nitrogen fertilizers for corn—mainly for more bushels per acre—with some little thought about the possible increase in total "crude" protein in the grain and probably a help to more quality as animal feed. We are not yet much concerned about the declining protein in the wheat which goes more directly into human food than the corn does. We are not yet analyzing the problem of the proteins as one of getting the combinations of the specific amino acids which may be necessary within these plants themselves, if they are to multiply their own cells in their own growth before they can make seed, reproduce, or pass to us by any means the specific amino acids we must get to keep ourselves alive by consuming their products.

Unfortunately, for ourselves, in connection with the protein foods and the protein-supplementing feeds, we have already too long called anything protein when it contains nitrogen in some organic combination. Nitrogen can occur in many combinations with carbon, hydrogen, and oxygen as plant or microbial creations without rendering such services in nutrition like cell multiplication or keeping life flowing, which really come with the true proteins. To date we have not made sharp distinctions about the quality—for our nutrition—of the nitrogen in our organic compounds, when little more than half of the organic nitrogen we feed or eat is really in the *amino* combination for which we emphasize the *amino* acids. We must become more specific in our thinking about proteins by considering them a balanced combination of their component amino acids as the human or animal body requires them. We dare no longer be satisfied to burn the food substance in sulfuric acid, collect the nitrogen coming out of it, then multiply that by a mathematical factor, like 6.25 or 5.73, and as nutritionists call the result the amount of protein. Such protein is only "crude" protein and certainly one all too crude to be taken as the basis for complete nutrition.

Because we have not seen the legumes as producers of the proteins for themselves first, and producers of proteins for our livestock second, we have been accepting substitute legumes in place of fertilizing or feeding the choice, or starving, crop its necessary help for making its required proteins. We need to think of this way of providing protein supplements for growing the crop instead of merely juggling many of the crops. While we have indulged in crop juggling to keep in our hands those giving big yields, we have dropped those giving the more complete proteins.

When red clover—a forage feed excellent enough apparently to call for no supplements to make it serve as complete proteins for livestock—began to fail, we took up the fight on soil acidity. We haven't learned very much yet about fertilizing red clover so that it can grow its own proteins to make good feed or good seed of itself, if one dare judge by the scarcity of the crop and of the supply—in spite of the high price—of red clover seed.

In place of finding successful red clover crops through fertilizing the soil with whatever it takes to nourish them, we have taken to sweet clover widely. This substitute crop contains much nitrogen, even sometimes more than can be had in red clover. It may thus be considered a crop higher in crude

protein. But in the cow's choice between these two legume forages, she breaks through the fence to get to the former, while if confined by a fence within a field of the latter she refuses to eat it as long as the fence rows and washes offer any other herbage. She would break through the fence to get away from sweet clover. When she stands inside the field by the gate and bellows, she is trying to tell us that the crude protein in sweet clover is much more crude in her judgment than is that in red clover. She is telling us that we are supplementing, by lime on the soil, what is needed to help sweet clover make the proteins it must have to grow itself into a crop. She is also telling us that we have juggled out the red clover because we don't fertilize the soil to supplement the protein-producing functions within that crop by which it grows itself into a good crop of nutritious protein feed. For feeding these crops well, soil fertility is needed, and of a list that includes any element, major or trace, necessary to make proteins possible as each crop requires them for its own growth.

Pattern of crops' creations of specific amino acids is apparently premised on the pattern of soil fertility.

Alfalfa grows well with little added fertility on soils blown by the wind from out of the Missouri River bottoms. It grows well on such soils representing deposits of soil materials brought from much farther West. Alfalfa came to the United States from semi-humid and almost arid areas. It does so well in our Midwestern region of low rainfall because soils there are mineral-rich and so well-mixed that they offer as nutrition most any element a crop might need. But in the Cornbelt, alfalfa is considered "hard to grow." We do not yet know with much certainty just what must be given to the soils there to "make a stand of alfalfa stay," or to keep it from starving out for want of the help it needs to make its essential amino acids or to create the proteins by which it survives.

But on some of the soils where alfalfa fails, we have shown that the use of trace elements as nutritional supplements for this crop will increase its own concentration of those amino (3) acids which are very low or almost absent in corn (4), and even some which are so in wheat (5). Can it be possible that in finding corn "so well adapted" to the soils of the Cornbelt, we have merely found a grain crop that doesn't require the amino acid tryptophane for its own growth, and thereby are growing this grain too low in this essential amino acid for even the fattening of hogs without protein supplements? Can it be possible that we have juggled this tryptophane-deficient crop onto this soil of which the deficient fertility prohibits any crop's production of the amino acid tryptophane? This question sounds like a plausible truth when alfalfa, grown on the Western soils, can make this amino acid within itself of concentrations high enough to serve on importation to the Cornbelt as protein supplement to corn not only for fattening nearly mature and castrated animals, but also for growing young ones.

But alfalfa is in trouble on some of the Western volcanic soils of such recent deposit that they are deficient in sulfur because of volcanic ignition. Sulfur is a necessary help on these sulfur-deficient soils for the alfalfa's conversion of atmospheric nitrogen into certain amino acids. Sulfur is a structural part of the essential amino acid, methionine. Peanuts fail to be a complete protein food or feed because of the deficiency in this essential amino acid. Can they be a crop that has been fitted onto the highly weathered soils of the South, out of which the sulfur has gone and where it has not been regularly replaced for protein-wise nutrition of other crops requiring methionine in their own growth?

When soybeans growing on the sandy soils of southeast Missouri synthesize methionine, this often-deficient amino acid, in greater concentrations in their forage when they are fertilized with sulfur, and do likewise when increasing offerings of sulfur are given the plants in carefully controlled laboratory-greenhouse tests (6), shall we not ask ourselves whether crop failures result from protein shortage as amino acid combinations within those crops for their own growth? Isn't it possible that the ecological array of crops is the pattern of sets of amino acids in the plant proteins according as the fertility of the soil supports or prohibits them? It seems as though our study of the amino acids permitted in the plants according to the soil fertility should be a helpful contribution to our problem of the production of complete proteins. Knowledge gained from such study should prop up the proteins more securely for plants and in turn for animals and for people in what appears to be an efficient way.

Declining fertility bringing lowered concentrations of crude proteins in crops brings on us the problem of detecting their amino acid deficiencies.

While we are slowly recognizing the declining concentrations of proteins in our corn and our wheat, the seriousness of that decline is not yet realized widely enough for much to be done about it. The introduction of hybrid corn was hailed as a boon for more bushels per acre. We are just now recognizing the resulting decline in the concentration of protein in the grain associated with the extensive use of hybrids. When the proteins appear in both the germ and the endosperm of the kernel; when the resulting crop is never used as seed to report its low protein through failure of both germination and growth; and when the loss of "hardness" in the endosperm is not considered as loss in quality; we are not apt to see that, during only four decades, the concentration of the average crude protein in corn has fallen from 10.3 per cent to a figure as small as 7.9 per cent in the fifth or lowest grade of corn listed on the markets today.

In the case of wheat, the pre-harvest protein surveys, taken by counties over the State of Kansas by the Crop Reporting Service of the U. S. Department of Agriculture in 1940 and 1949-1951, tell of the declining concentration of the protein in this food grain. In the first year of the survey, the concentration ranged from a low of 10 per cent to a high of 18 per cent as county averages. This was an increase in protein concentration, or mainly in horniness or "hardness" of the endosperm of the grain with the transverse across that State from east to west, or with decreasing annual rainfall. While no such surveys were made for the years between 1940 and 1949, some half dozen of the largest wheat crops in the State's history were produced to haul nitrogen out of the soil and out of the State in such quantities that it is not surprising to find the surveys for 1949 to 1951 reporting no county average of protein going over 15 per cent. The last year of that record gave the range of county averages from 10 to only 14 per cent. Big yields as bushels of grain with a starchy endosperm have kept us oblivious to the decline in delivery by this food crop of the proteins that were once given us by it in much higher concentrations.

What this decline in concentration of "crude" proteins means in terms of the changed array of the different amino acids composing them has not yet seemed seriously challenging. But when this more western wheat State once grew alfalfa which served as the imported protein supplement for corn in the Cornbelt and when that State now grows a wheat of no higher protein concentration than that of wheat grown on the Cornbelt soils, shall we expect that State's protein-producing

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Growing Better Turnips

By R. J. Bryden

Department of Soils, Ontario Agricultural College, Guelph, Ontario, Canada

Fig. 1. Crisped with the October frost, these mellow-flavoured, golden-fleshed Laurentian rutabagas are found as a cheap luxury on the tables of all Canadians and Americans who love good food.

TURNIPS, or if one prefers the term, rutabagas, have long held a place of high regard on the tables of the consumer as well as in the feedlots of cattle, sheep, and other farm animals. For where else can one enjoy the delightful combination of flavour, appearance, aroma, and high food value found in the well-grown Swede turnip.

Not only are turnips nutritious, but they are always abundant and relatively cheap. Thus, turnips are found in the diets of rich and poor, the epicure and the hungry labourer, the farmer and the city worker, in good times and bad.

Upon this universal taste for turnips has been built a substantial industry in Eastern Canada, namely, that of producing, harvesting, processing, and marketing a crop of 20 million bushels annually. While most of these turnips are consumed in Canada, many carloads are destined for United States markets and may be found in food stores chiefly in the Southern States east of the Mississippi River.

Almost anyone can grow turnips, but only the expert can produce crops of high quality with good flavour and appearance. Climate is important. Only the frosty nights of late October and November prevailing in the northerly latitudes can impart that crisp texture and mellowed flavour so much desired by the turnip-hungry addict.

Mineral soils well provided with organic matter are best suited for turnip production. Applications of manure can usually be applied profitably to the turnip crop. The Division of Illustration Stations of Canada reports that with applications of manure alone, an average yield of 17.67 tons per acre was secured over a nine-year period. However, when fertilizers were applied along with the manure, the average yield rose to 23.66 tons per acre.

Over a period of years much investigational work in turnip nutrition has been undertaken by the Soils Department of the Ontario Agricultural College, Guelph. Soil testing has been used as a basis for fertilizer applications, and with few exceptions, a good correlation has been found between turnip yields and applications of plant food based on soil tests. There is still room for further work along this line.

In 1950, six field tests were conducted in Ontario to study the use of soil tests as a guide in applying fertilizers. In most cases where any one nutrient ele-

TABLE I.—STATUS OF NUTRIENT LEVELS AS INDICATED BY SOIL TESTS

Test No.	Texture	Drainage	P_2O_5	K_2O	Ca	MgO	pH
1	Clay loam	Fair	High	Low	High	Low	7.1
2	Sandy loam	Good	Med.	Med. to low	Low	High	6.8
3	Silt loam	Good	Low	Low	High	High	7.0
4	Silt loam	Good	Med.	Med.	High	High	6.6
5	Sandy loam	Good	Low	Low	Med.	Low	7.1
6	Sandy loam	Good	Low	Very low	Med.	Low	6.2

ment in the soil was at a relatively high level, the response to that element was not very great. The reverse was true where any nutrient was found to be seriously deficient.

As is usually the case in field trials, there is seldom complete consistency, but the trends are sufficient to warrant the use of soil tests as a guide at least in choosing the more desirable fertilizer mixtures.

Table I shows the rating given the various farmers' soils by conventional soil-testing procedures.

Table II describes the plot arrangement by which the relative response of the turnip to phosphorus and potassium was observed. This test was carried out on six farms in Southern Ontario in 1950.

TABLE II.—PLAN OF PLOT TREATMENT BASIC APPLICATION 4-12-10 AT 1,000 POUNDS PER ACRE

Plot number	Treatment
1-NPK	4–12–10
2-PK	0–12–10
3-NK	4– 0–10
4-NP	4–12– 0

Data in Table III show the effect of omitting P_2O_5 from the fertilizer under conditions of high, medium, and

Fig. 2. Extensive fertilizer tests indicate the nutritional requirements of the turnip crop. This shows a portion of the experimental area on the farm of John Houser, Guelph, Ontario, who operates a turnip-waxing plant in addition to producing table turnips.

low phosphate levels in the soil as shown by soil tests.

TABLE III.—DIFFERENCE IN YIELD OF TURNIPS WHERE P_2O_5 WAS OMITTED

Test No.	Soil test for P_2O_5	Yield from basic treatment	Yield when P_2O_5 is omitted	Difference
		(*Bushels per acre*)		
1	High	910	860	Minus 50
2	Med.	950	802	Minus 148
3	Low	1,108	758	Minus 350
4	Med.	1,275	980	Minus 295
5	Low	1,070	870	Minus 200
6	Low	1,060	590	Minus 470

Data in Table IV show the effect of omitting K_2O from the fertilizer under conditions of medium, low, and very low K_2O reserves in the soil as indicated by soil tests. None of the soils tested high in potash.

TABLE IV.—DIFFERENCE IN YIELD OF TURNIPS WHERE POTASH WAS OMITTED

Test No.	Soil test for K_2O	Yield from basic treatment	Yield when K_2O is omitted	Difference
		(*Bushels per acre*)		
1	Low	910	800	Minus 110
2	Med.	950	769	Minus 181
3	Low	1,108	1,086	Minus 22
4	Med.	1,275	1,275	0
5	Low	1,070	940	Minus 130
6	Very Low	1,060	590	Minus 470

These data show that in the majority of cases soil tests indicated the probable response from the major plant foods, P and K. Increasing numbers of farmers are using this service of soil testing provided by various government and industrial laboratories as a useful guide in employing more economical kinds and amounts of fertilizers. When test shows soils to be deficient in phosphorus, a response to that element is generally noted. Turnips seem to have particular difficulty in absorbing through their restricted root systems sufficient phosphate for the crop's needs. Most fertilizers used for turnips contain at least 12 per cent P_2O_5.

A table for nitrogen response has not been compiled due to the fact that the soil tests give the amount of available nitrate nitrogen at the time the sample is tested. This fluctuates considerably depending on conditions at time of sampling. It was also felt that most growers appreciate the necessity of applying sufficient quantities of manure to supply the needs of the turnip crop well ahead of sowing turnips in order to avoid root rot and maggot infestations. They realize that the soil needs to be well supplied with organic matter to maintain good physical condition and structure so necessary to rapid growth and high quality for this short-season crop.

Little, however, seems to be known of the response of this crop to potash. Consequently, in 1949, the writer designed some field tests in the hope that some data might be gathered on this phase of turnip nutrition. Table V shows the response to potash applied in addition to the regular fertilizer employed by the growers. These men have all been growing and shipping turnips for a number of years.

While averages can be and often are misleading, it may be observed from this table that an average response of 124 bushels per acre was secured from these 10 tests by the application of 200 pounds per acre of additional muriate of potash.

Some growers were found to be applying salt to their turnip crop. Some field tests were conducted in which salt (NaCl) was applied, but in no case was a favourable response observed. In fact in some cases a depressed yield was indicated. In one

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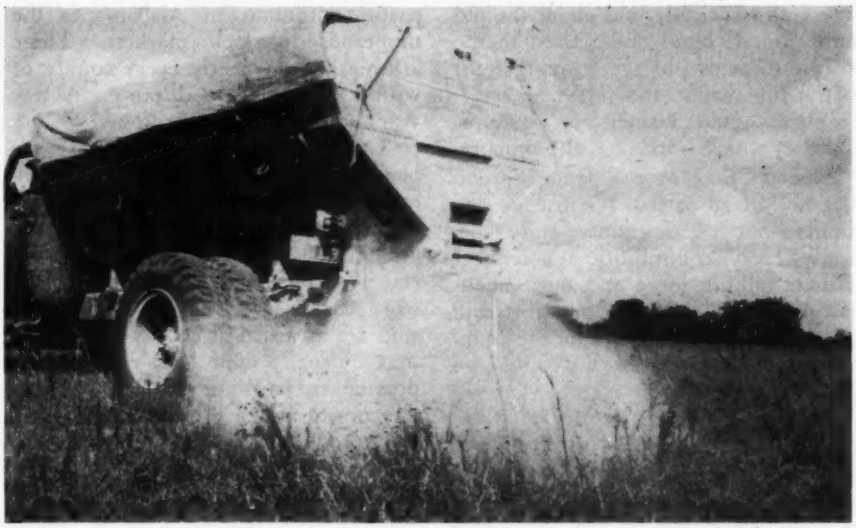

Fig. 1. Spreading fertilizer on an established pasture in Montgomery County, Alabama.

The Pasture Program in Alabama

By J. C. Lowery

Agronomy Department, Alabama Polytechnic Institute, Auburn, Alabama

THE pasture program keeps rushing along in Alabama toward the goal of making Alabama a pasture state. Just nothing like the pasture movement has happened before in Alabama agriculture. It started in 1935 from almost a "casual dare" of setting a goal of at least one improved pasture in every agricultural beat (or precinct) in Alabama. No one dreamed then that pastures would become a main source of cash income in a few years. But a long-time program centered on demonstrations was planned.

There is nothing like having a sound, long-time program and "hitting it hard" every year. At first, the idea of fertilizing a pasture was a joke. Few looked on pastures as a crop requiring right locations as to soil, good soil preparations, fertilizers, and seeding the right plants on time. Pastures were just simply land too poor for row crops. You wired it in and let bushes, weeds, native grass, and cows fight it out.

The story would be too long if it included the "ups and downs" of the pasture movement and the many persons and organizations which have worked at the pasture job. It is well, however, to point out a few interesting features. From 1935 to 1940 much stress was placed on demonstrations. Untreated check plots and "check pens" were featured. Farmers saw the increased growth due to soil preparation and good fertilization. In the check pens they got a measure of the growth being grazed.

On tours and at meetings farmers told how their animals grazed up to the line of fertilization. One farmer

very enthusiastically told about the old family horse, blind and retired to the pasture to enjoy old age, grazing right to the line where the fertilizer came. Fertilizers paid farmers on pastures and they quickly accepted the practice.

Now it's no longer a demonstration idea nor a trial patch. It's just not one county—but every county and practically every community. You hear farmers talking more and more about pastures, and they are making and using them. On the farm, at the country store, the courthouse, the bank, seed store, the fertilizer plant—wherever farmers go they are asking questions about pasture problems and swapping experiences.

But the pasture program in Alabama does not aim to remove row crops from the farming system. Of course, there are some who should practically abandon row crops. But most Alabama farmers continue their row-cropping and develop a pasture program to use more land wisely. They are fitting pastures into their row-crop system and making the land not in row crops an important "money-making" part of the farm.

Another testimony to success of the pasture program in Alabama is the numerous livestock markets. There are markets in nearly every county or within a reasonable distance. A few years ago there were very few.

"County Green Pasture Clubs" are being formed in many counties. Farmers become eligible for membership when they have reached certain standards in pasture improvement. Progress is determined by use of pasture score cards. Certificates of membership are awarded at county-wide meetings. Usually some local organization provides a barbecue or dinner for a meeting to award the membership certificates.

Since the beginning of the pasture program about 1935 more than two and a quarter million acres of permanent pastures have received some type of improvement practice.

Green grazing in winter was an unheard-of practice. Now crimson clover and rye grass are recognized as a standard pasture mixture for winter grazing. The caley pea (wild winter pea) is now the standard winter-grazing crop in the Black Belt area of Alabama. Its sudden popularity was the discovery

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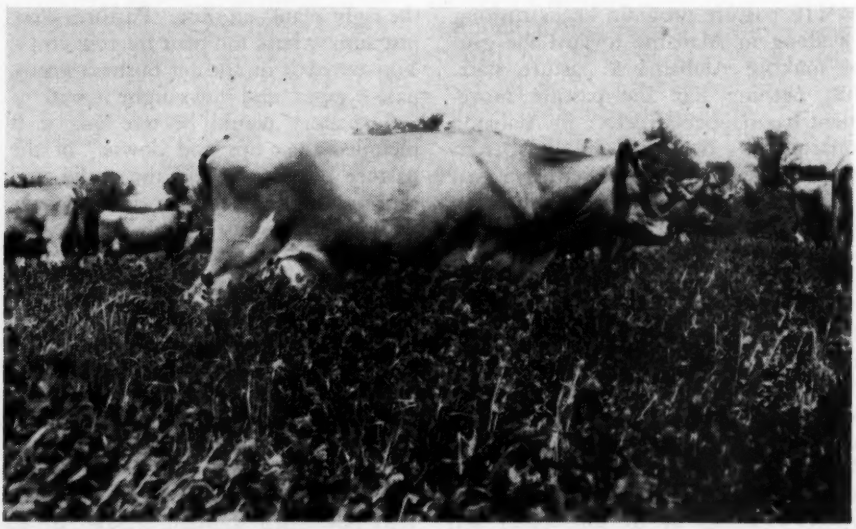

Fig. 2. Dairy cows in crimson clover and rye grass, Talledega County, Alabama, May 1, 1950.

Weed Control

By Glenn C. Klingman

Agronomy Department, North Carolina State College of Agriculture, Raleigh, North Carolina

JIM BROWN considered himself a good farmer. He used the best of crop varieties and reasonable quantities of fertilizer. The corn was kept clean until it was laid by, but then morning glory, cocklebur, and other weeds came in to smother out his corn, made harvesting difficult, and materially reduced the return for his effort and the return on the money spent for fertilizer and seed. This type of condition is illustrated in Figure 1 where the corn yield was 75 bushels per acre but the problem of harvesting was difficult.

Figure 2 illustrates what can be accomplished in the same field where the weeds were controlled with one preemergence application of 2,4-D. No cultivation was used after planting and the corn yielded 91 bushels per acre. Not only was the yield increased 16 bushels per acre with the same fertilization and hybrid, but it is obvious that the harvesting operation was made much easier.

According to old ideas, weeds were considered a necessary evil and there wasn't much that could be done about them. The cost of weeds is estimated at $450 per farm for the average farmer. Farmers do not usually appreciate the extent of reduced crop yields, crop quality, and the number of insects and diseases harbored by the weeds, as well as the increased cost of harvesting when weeds are present.

In many cases, failure to control weeds makes void the beneficial effects of better soil management, improved varieties, and better farm machinery.

A satisfactory weed control program is nearly always associated with management practices that are known to increase agricultural production. For example, competition to weeds is increased by properly fertilizing the crop, by the use of vigorously growing crops,

Fig. 1. Corn completely wrapped up with morning glory and other weeds. Harrowed and cultivated, the field was clean by lay-by time. Yield —75 bushels per acre.

Fig. 2. Same field, corn, and fertilization as shown in Fig. 1. No cultivation was used after planting; weeds were controlled with one preemergence application of 2,4-D. Yield—91 bushels per acre.

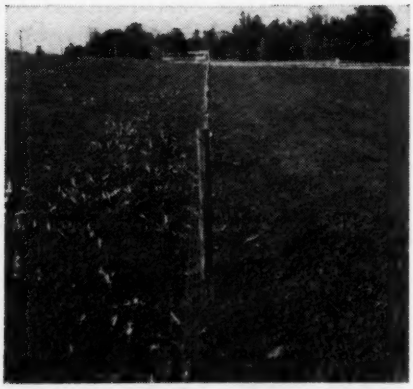

Fig. 3. Curled dock controlled in ladino, orchard grass pasture. Right of fence, treated with one pound of 2,4-D in early September to remove curled dock; left along fence, curled dock still growing; far left, experimental plots on weed control.

and the proper date and rate of seeding the crop.

In the past, too little emphasis has been paid to the actual control of the weeds themselves. Practically all research was directed toward other activities even though weed control was and still is one of the major costs of crop production. However, some of us working in the field of weed control are concerned now that the farmer will try to depend too completely on the newer selective weed killers. If properly used, they are truly remarkable, yet they cannot carry the load alone. The extent to which they are being used by U. S. farmers is shown by the rise in the production of 2,4-D as given below.

Year	*2,4-D Production (U.S.) (pounds)*
1945	917,000
1947	5,629,000
1949	28,000,000

If all the 2,4-D in 1949 was applied as a post-emergence spray to corn, there would have been sufficient to have sprayed two-thirds of all the field corn produced in the United States.

This last spring I was invited to look at a new grass-legume seeding that was being taken over by weeds. The farmer had used too little of a chemical weed killer and had received poor results. In looking over the field several patches of heavy grass-legume growth were found. It appeared that fertilizer may have been spilled or that manure may have been applied heavily to the spots. On closer examination the weeds were found to be present in the thick green spots, too, but they had been crowded back to where they were doing little harm. Later, following adequate fertilization the grass-legume was no longer held back by the weeds. It served to emphasize that a balanced farming program, whether it be fertility, soil moisture, crop rotation, improved varieties and clean seed, improved cultural methods or the proper use of chemical weed control is needed for efficient weed control and an efficient agriculture.

Even though most of the above management practices are carefully included in the farming program, weeds may continue to be a problem. Frequently chemicals are the most efficient and the easiest method of control. We now have over 20 different chemicals that have proven their weed-killing ability. Only after considerable research can the best use of each one be determined. Trials must be made with each crop and also with each weed species involved.

Research as well as the experience of many farmers has shown that weeds can be chemically controlled in corn, small grains, rice, flax, alfalfa, pastures, in some vegetables and fruits, on ditch banks, irrigation ditches, lakes and ponds, and in turf and lawn areas. Undesirable trees and brush can be removed from woods and grazing areas. In each case the treatment is dependent upon the crops and weeds concerned. It would be impossible to give individual recommendations here. Even though the science of weed control, as we presently know it, has developed primarily since 1945, most experiment stations are now able to give

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Magnesium and Potassium Nutrition for Sweet Potatoes In the Coastal Plain

By J. B. Hester, R. L. Isaacs, Jr., and F. A. Shelton

Department of Agricultural Research, Campbell Soup Co., Riverton, New Jersey

MAGNESIUM deficiency has been a problem on the Coastal Plain soils in sweet potatoes for a number of years. Early work has shown that several thousand acres were seriously affected by magnesium deficiency. While the use of dolomitic limestone has generally corrected the deficiency of some crops, it is not used in crop rotations involving sweet potatoes. Therefore magnesium nutrition, from the standpoint of that present in fertilizer mixtures, is very important.

Research work[2] published in the past has shown an interrelation of magnesium and potassium fertilization from the standpoint of crop production. The maximum advantage of potash fertilization has not been realized because of the result of magnesium deficiency. There is an interrelation between the absorption of magnesium and potassium as shown by Bear[1] and others. The question of magnesium deficiency is also interrelated with the rainfall and ionization dissociation of magnesium and potassium from the clay and organic matter complex of the soil.

Work with soil analysis using the Hester method has indicated that when this test shows less than 100 lbs. of available magnesium oxide per acre, magnesium deficiency results with normal fertilization.

1951 Experimentation

Because of the fact that there was a clear-cut relation between the magnesium and potassium concentration in the fertilizer mixture, experimentation was designed to ascertain the optimum amount of magnesium and potash in the fertilizer mixture to produce a maximum yield of high-quality sweet potatoes. Five replications of 1/80-acre plats of fertilizer analyses were used. (See Table below.)

These experiments were conducted on an Evesboro loamy fine sand which analyzed as per Table next page.

Eight hundred pounds of each fertilizer mixture per acre were mixed in the row on May 30. Ranger sweet

3–9–0	3–9–6	3–9–12	3–9–18
3–9–0+2% MgO	3–9–6+2% MgO	3–9–12+2% MgO	3–9–18+2% MgO
3–9–0+4% MgO	3–9–6+4% MgO	3–9–12+4% MgO	3–9–18+4% MgO
3–9–0+6% MgO	3–9–6+6% MgO	3–9–12+6% MgO	3–9–18+6% MgO
3–9–0+8% MgO	3–9–6+8% MgO	3–9–12+8% MgO	3–9–18+8% MgO

Horizon	pH	Pounds/A		Aluminum	% Organic Matter	NH_4	Pounds per acre		
		CaO	MgO				NO_3	P_2O_5	K_2O
Topsoil	5.4	397	144	Trace	1.1	Poor	11	58	162
Subsoil	5.0	98	50	High	0.7	Poor	2	10	104

potatoes were set on June 5 and 6. On July 20 an additional 800 lbs. of each fertilizer mixture were added as a side-dressing. The potatoes were irrigated once during the season. There were such small amounts of rainfall at any one time during the season (1.44 inches total) that very little benefit was derived from it. The two center rows of each plat were harvested on October 30 and 31 and yield records obtained. The potatoes were divided into three grades, No. 1, No. 2, and culls.

The results of this experiment are shown in Fig. 1. The 3-9-18+2% magnesium oxide, one-half from soluble sources and one-half from dolomitic limestone, produced the maximum yield. This is not entirely in keeping with the previous results. It was anticipated that 4 or 6% magnesium oxide in the 3-9-18 fertilizer mixture would produce maximum yields, but due to the unseasonably dry weather, leaching was not a factor from the standpoint of the available magnesium. It is anticipated that this work will be repeated in the same location another year to determine the influence of climatical conditions.

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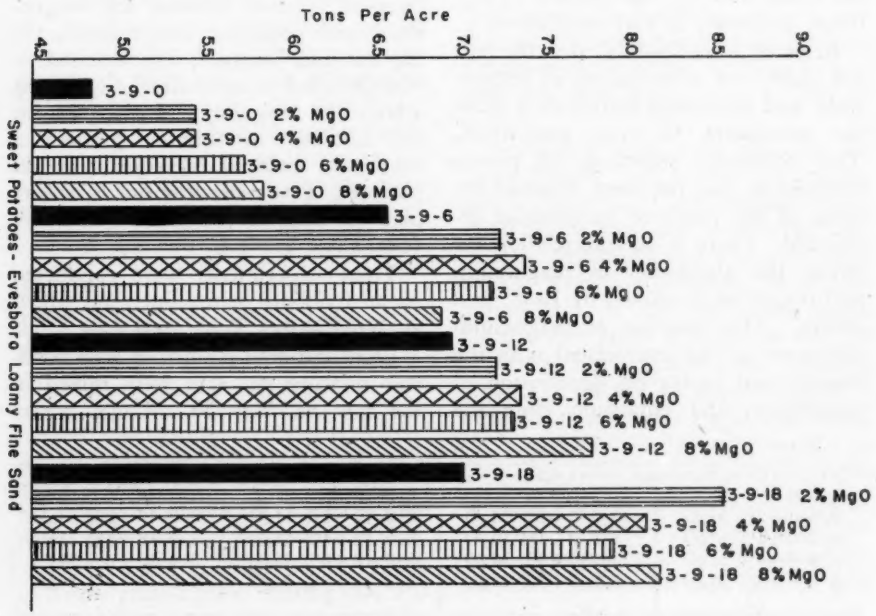

PICTORIAL

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Time

School Time

The Editors Talk

Agriculture's Yearbook

"INSECTS" is the title of the new 1952 Yearbook of Agriculture prepared by the U. S. Department of Agriculture and for sale at $2.50 per copy by the Superintendent of Documents, Government Printing Office, Washington 25, D. C. This 952-page volume follows in the line of new Yearbook series begun in 1936 which treats specifically of one important phase of agriculture each year. With such treatment, the Department is providing valuable reference material along with usable, up-to-date information for all who want to keep up with the progress in scientific agriculture.

This year's book will not only find a prominent place in the farm library; it is of interest to the city dweller. Such chapters as "Warnings as to Insecticides," "Insects, Man, and Homes," and "Pests on Ornamentals" will have wide appeal. An outstanding feature is a section of 72 color plates of the important insects of the United States. The drawings depict the life stages of the insects and the damage they do. Opposite the drawings are descriptions and control recommendations. In addition, eight black-and-white photographs and more than 200 line drawings will help readers identify insects. Altogether the 110 articles in the Yearbook discuss more than 800 of the "enemy" to our more prosperous and comfortable living.

The Department is to be congratulated for this outstanding volume, the recipients of which will be so much better prepared to understand and deal with the problem which is estimated to cost us four billion dollars a year.

Potash Production in America

In response to the many and continued requests for an educational film on the production of potash, the American Potash Institute has just completed a new and up-to-date motion picture which is being made available through its distributors (see page 46) on free loan to the groups specified.

The film is in color and sound with a running time of approximately 25 minutes. Narration begins with the discovery of the effects of potash on plant growth by our American Indians, who placed wood ashes in their hills of corn. As the country developed and wood ashes no longer were available in sufficient quantities, the depletion of our soils being farmed began and continued until large quantities of potash were imported from Europe. This dependence on European sources was cut off at the start of World War I, and then began a frantic search for sources of this essential plant food in this country. The only one of any importance and that has held over to current use was the recovery of

potash from the brine of a dried-up salt lake at Trona, California. In 1926 in connection with drilling for oil, potash deposits were found in southeast New Mexico. The development of mines in this region together with the production at Trona has now made this country entirely independent of any foreign sources.

This narration is backgrounded with scenes showing the taking of the brine from Searles Lake and the processing of this brine to obtain the potash salts. Scenes in mines at Carlsbad, New Mexico, show how the ore is blasted out, brought to the surface of the ground, conveyed to the refineries, and processed for the finely ground and granulated forms used in commercial fertilizers and other products of the chemical industry.

While the fact that potash is one of the necessary plant foods is well known, it is surprising how many people do not know the sources of the mineral and how it is prepared for use in agriculture and industry. The Institute is hoping that this new film will help materially in supplying this information.

Our Cover Picture

The apricot is a delicately flavored stone fruit which has been grown for many years throughout California. It finds a market as fresh, canned, dried, and frozen fruit and as juice. By-products are manufactured from the pits of the fruits. Last year California produced 172,000 tons of apricots valued at $19,488,000. The 1952 production is estimated at 155,000 tons. One of the coastal regions of the State, the Santa Clara Valley, and immediately adjacent areas have 24,000 acres devoted to this fruit crop—a little over half of the total State acreage.

Until a few years ago, symptoms of potash deficiency on the apricot had not been identified. Trees showing abnormalities had been noted in a number of localities, and the symptoms had been studied. By means of leaf analysis followed by field applications of potash, deficiency of potassium has been established recently in several areas in Santa Clara Valley.

In severe cases, the trees are stunted and extensive cutting back of limbs is apparent due to yearly "die-back." The leaves of deficient trees fold upward and the edges curl. These leaves are yellowish-green in color, and browning or scorch appears at the tip, along the edges, and proceeds inward between the veins.

The affected leaves at the right of the cover illustration had 0.6% potassium (dry matter basis) in July. The leaves of adjacent treated trees, as depicted at the left of the cover illustration, had 2.1% potassium. A favorable change in the level of this plant food may be brought about in one year by a heavy application of potash. Usually such an application causes the potash to build up in the tree over succeeding years until an optimum level is attained.

Sometimes, the symptoms of excessive sodium intake are confused with those of potassium deficiency. Apricot trees injured by too much sodium also show "die-back" of branches, and the leaves burn or scorch along the edges. However, many such leaves usually have a circular, cupped shape and the scorch is marginal.

A leaf analysis can be depended upon to determine sodium excess or potassium deficiency if there is doubt about the visual symptoms. Leaf content above 0.2% sodium (dry matter basis) may well mean sodium excess trouble, while leaf readings below 1.5% potassium indicate insufficient potash for best apricot production.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay [1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1926.....	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927.....	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928.....	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929.....	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930.....	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932..	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936.....	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938.....	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941.....	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942.....	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943.....	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945.....	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946.....	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947.....	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948.....	30.4	48.2	155.0	222.0	129.0	200.0	18.45	67.20	....
1949.....	28.6	45.9	128.0	214.0	124.0	188.0	16.50	43.40	....
1950.....	40.1	51.6	91.6	173.0	153.0	200.0	16.70	86.50	....
1951									
August.....	34.60	47.7	117.0	273.0	165.0	205.0	15.65	69.10	....
September...	33.73	52.4	123.0	287.0	165.0	207.0	16.55	66.10	....
October.....	36.21	57.7	139.0	271.0	164.0	210.0	17.15	69.90	....
November....	41.00	50.0	174.0	280.0	162.0	219.0	18.35	72.70	....
December....	40.34	51.0	193.0	305.0	169.0	222.0	19.65	71.50	....
1952									
January.....	38.70	46.2	207.0	347.0	168.0	220.0	20.75	70.10	....
February....	37.25	33.8	205.0	357.0	166.0	218.0	20.65	67.10	....
March.....	36.72	23.5	216.0	383.0	165.0	220.0	20.35	61.50	....
April.....	37.30	15.0	231.0	416.0	168.0	218.0	20.05	60.80	....
May.....	36.08	43.5	264.0	433.0	170.0	213.0	18.65	60.80	....
June.....	38.02	44.0	310.0	436.0	173.0	206.0	17.05	61.90	....
July.....	37.02	42.0	274.0	446.0	173.0	198.0	17.25	71.00	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1926.....	101	179	189	134	116	138	112	98	139
1927.....	163	207	146	124	132	135	87	154	127
1928.....	145	200	76	134	131	113	95	152	154
1929.....	135	183	189	133	124	117	92	137	137
1930.....	77	128	131	123	93	76	93	98	129
1931.....	46	82	66	83	50	44	73	40	115
1932.....	52	105	55	62	50	43	52	46	102
1933.....	82	130	118	79	81	84	68	57	91
1934.....	100	213	64	91	127	96	111	146	95
1935.....	90	184	85	80	102	94	63	135	119
1936.....	100	236	164	106	163	116	94	148	104
1937.....	68	204	76	89	81	109	74	87	110
1938.....	69	196	80	79	76	64	57	97	88
1939.....	73	154	100	84	88	78	67	94	91
1940.....	80	160	78	97	96	77	64	96	111
1941.....	137	264	116	105	117	107	82	211	129
1942.....	153	369	168	134	143	124	91	202	163
1943.....	160	405	188	235	174	154	125	231	245
1944.....	167	420	214	216	170	160	139	234	212
1945.....	181	366	205	232	198	170	127	227	207
1946.....	263	382	178	248	212	209	141	319	182
1947.....	257	380	232	248	336	259	148	381	226
1948	245	482	222	253	201	226	155	298	214
1949.....	231	459	184	244	193	213	139	192	201
1950.....	323	516	131	197	238	226	141	384	185
1951									
August.....	279	477	168	311	257	232	132	306	181
September...	272	524	176	327	257	234	139	293	161
October.....	292	577	188	309	255	238	144	310	171
November...	331	500	250	319	252	248	155	322	249
December....	325	510	277	347	263	251	166	317	331
1952									
January.....	312	462	297	395	262	249	175	311	337
February....	300	338	294	407	259	247	174	298	217
March.....	296	235	310	436	257	249	171	273	265
April.....	301	150	331	474	262	247	169	270	308
May.....	291	435	379	493	265	240	157	270	285
June.....	307	440	445	497	269	233	144	275	250
July.....	299	420	393	508	269	224	145	315	287

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
1950	3.00	1.95	11.01	11.70	10.21	9.36
1951						
August	3.13	2.07	11.94	10.41	8.66	8.66
September	3.13	2.07	11.50	10.78	9.26	9.26
October	3.13	2.07	12.85	11.28	10.56	10.32
November	3.34	2.07	13.93	11.28	10.39	10.25
December	3.34	2.07	14.27	11.28	10.08	10.02
1952						
January	3.34	2.07	14.27	11.28	10.39	12.16
February	3.34	2.07	14.27	11.28	11.61	11.08
March	3.34	2.07	14.26	11.28	9.71	9.04
April	3.34	2.07	14.26	11.28	8.80	8.05
May	3.34	2.07	14.25	11.28	7.75	7.36
June	3.34	2.07	14.27	11.28	8.38	8.38
July	3.34	2.07	14.26	11.28	8.19	7.59
Index Numbers (1910-14 = 100)						
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
1950	112	68	315	331	303	266
1951						
August	117	73	341	295	257	246
September	117	73	329	305	275	263
October	117	73	365	320	313	293
November	125	73	398	320	308	291
December	125	73	408	320	299	285
1952						
January	122	73	408	320	308	345
February	125	73	408	320	344	315
March	125	73	407	320	288	257
April	125	73	407	320	261	229
May	125	73	407	320	230	209
June	125	73	408	320	249	238
July	125	73	407	320	243	216

Wholesale Prices of Phosphates and Potash * *

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[1]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
1950	.763	3.83	5.47	.371	.716	14.33	.195
1951							
August	.810	3.98	5.47	.389	.768	14.72	.193
September	.810	3.98	5.47	.386	.768	14.72	.193
October	.820	3.98	5.47	.386	.768	14.72	.193
November	.820	3.98	5.47	.386	.768	14.72	.193
December	.820	3.98	5.47	.420	.827	16.00	.210
1952							
January	.820	3.98	5.47	.420	.827	16.00	.210
February	.820	3.98	5.47	.420	.827	16.00	.210
March	.832	3.98	5.47	.420	.827	16.00	.210
April	.840	3.98	5.47	.420	.827	16.00	.210
May	.860	3.98	5.47	.420	.827	16.00	.210
June	.860	3.98	5.47	.353	.708	13.44	.176
July	.860	3.98	5.47	.386	.768	14.72	.193
			Index Numbers (1910-14 = 100)				
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
1950	142	106	112	68	75	59	83
1951							
August	151	110	112	70	81	61	82
September	151	110	112	70	81	61	82
October	153	110	112	70	81	61	82
November	153	110	112	70	81	61	82
December	153	110	112	75	87	66	85
1952							
January	153	110	112	75	87	66	85
February	153	110	112	75	87	66	85
March	155	110	112	75	87	66	85
April	157	110	112	75	87	66	85
May	160	110	112	75	87	66	85
June	160	110	112	65	74	56	80
July	160	110	112	70	81	61	82

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1926.....	146	150	146	119	94	135	112	86
1927.....	141	148	139	116	89	150	100	94
1928.....	149	152	141	121	87	177	108	97
1929.....	148	150	139	114	79	146	114	97
1930.....	125	140	126	105	72	131	101	99
1931.....	87	119	107	83	62	83	90	99
1932.....	65	102	95	71	46	48	85	99
1933.....	70	104	96	70	45	71	81	95
1934.....	90	118	109	72	47	90	91	72
1935.....	109	123	117	70	45	97	92	63
1936.....	114	123	118	73	47	107	89	69
1937.....	122	130	126	81	50	129	95	75
1938.....	97	122	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	123	130	127	86	56	130	102	77
1942.....	158	149	144	93	57	161	112	77
1943.....	192	165	151	94	57	160	117	77
1944.....	196	174	152	96	57	174	120	76
1945.....	206	180	154	97	57	175	121	76
1946.....	234	197	177	107	62	240	125	75
1947.....	275	231	222	130	74	362	139	72
1948.....	285	250	241	134	89	314	143	70
1949.....	249	240	226	137	99	319	144	70
1950.....	256	246	236	132	89	314	142	72
1951								
August....	292	271	258	135	94	294	151	74
September.	291	271	258	135	94	300	151	73
October...	296	272	259	140	94	335	153	73
November.	301	274	259	143	98	343	153	73
December..	305	273	258	144	98	342	153	78
1952								
January...	300	275	258	144	98	347	153	78
February..	289	278	255	146	98	365	153	78
March....	288	277	251	144	98	336	155	78
April.....	290	277	251	142	98	322	157	78
May.....	293	278	252	142	98	306	160	78
June.....	292	278	250	141	98	316	160	69
July.....	295	277	250	141	98	313	160	73

* U. S. D. A. figures, revised January 1950. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] All potash salts now quoted F.O.B. mines only; manure salts since June 1941, other carriers since June 1947.

** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. The maximum discount is now 16%. Applied to muriate of potash, a price slightly above $.353 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"General Recommendations—Fertilizers for Alaska 1952," Agr. Exp. Sta., Univ. of Alaska, Palmer, Alaska, Cir. 13 (Rev.) Jan. 1952, A. H. Mick, H. J. Hodgson, and M. F. Babb.

"Spectrochemical Methods for the Determination of Minor Elements in Plants, Waters, Chemicals, and Culture Media," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., A. P. Vanselow and G. F. Liebig, Jr.

"Sales of Commercial Fertilizers and of Agricultural Minerals Reported to Date for Quarter Ended March 31, 1952," Dept. of Agr., Bur. of Chem., Sacramento, Calif. Bur. of Chem. Announcement No. FM-226, May 14, 1952.

"Potato Fertilizer Trials, San Joaquin County Delta 1948, 1949, 1950 Summary," Ext. Serv., Univ. of Calif., Berkeley, Calif., Truck Crops Mimeo. No. 54 Apr. 1952, O. A. Lorenz, M. P. Zobel, and J. P. Underhill.

"Manures, Fertilizers, and Soil Amendments," Dept. of Agr., Ottawa, Ontario, Canada, Pub. 585, July 1951, H. J. Atkinson, J. C. Woodward, P. O. Ripley, M. B. Davis, and N. A. MacRae.

"Fertilizers for Various Crops," Dept. of Agr., Ottawa, Ontario, Canada, Pub. 870, Mar. 1952.

"Summary Total of Fertilizer Tonnages Shipped for Use in Delaware January 1 to December 31, 1951," Board of Agr., Dover, Del.

"Leaching of Fertilizer Phosphorus in Acid Sandy Soils as Affected by Lime," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Cir. S-32, July 1951, J. R. Neller, D. W. Jones, N. Gammon, Jr., and R. B. Forbes.

"Fertilizers, Fertilizer Materials and Rock Phosphate Sold in Illinois, July 1, 1951 to December 31, 1951," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG1531, June 1952, T. Kurtz and N. G. Pieper.

"Balanced Plant Nutrients Increase Profits," Ext. Serv., Purdue Univ., Lafayette, Ind., AY 73a, H. R. Lathrope.

"Preparing the Soil for and Fertilizing Sweet Potatoes," Ext. Serv., Univ. of Md., College Park, Md., Fact Sheet 23, Apr. 1951, E. K. Bender.

"Boron Deficiency in Alfalfa," Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 599, July 1951, A. W. Klemme.

"Effect of Different Sources of Fertilizer Nutrients and Different Rates of Fertilizer Applications on Yields of Vegetable Canning Crops—Beets, Cabbage, Peas, Sweet Corn, Tomatoes," Agr. Exp. Sta., Cornell Univ., Geneva, N. Y., Bul. 749, Feb. 1952, C. B. Sayre and M. T. Vittum.

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Pasture Program in Alabama . . .

(*From page* 18)

of its great response to phosphate.

One objective is to encourage bringing into use all land on the farm not needed for row crops that will produce some type of grazing. Part of the row crops fit into a grazing rotation.

What Is the Pasture Program?

The goal is: "A year-around pasture." Following are the basic parts:

1. A clover-grass permanent pasture . . . It is the basis of a pasture system. But climatic conditions are such that some supplementary grazing should be produced for stress periods. A permanent pasture will not meet grazing needs every month in the year.

2. Supplementary summer grazing . . . This is provided by such crops as sericea, lespedeza, Johnson grass (in the Johnson grass areas), kudzu, Sudan grass, and millet.

3. Supplementary winter grazing . . . This is provided by such crops as crimson clover and rye grass or oats, oats and vetch, or oats alone, caley peas, and other crops.

4. Substitute for permanent pasture . . . Some farmers have little or no land suited to permanent pasture. By means of supplementary summer- and supplementary winter-grazing crops, good grazing programs are provided.

A very important feature is production of surplus hay for emergencies due to drought or cold. Then, too, we need hay at periods in the spring when bloat is severe.

It is not expected that a farmer can develop a year-around system in one year. Usually it takes several years to develop a satisfactory system. And then changes are necessary from year to year.

Regardless of system developed there are certain essentials to success based on research of the Experiment Stations and observations of results obtained by farmers over a period of about 15 years.

The following are essential:

1. Locating plants or mixture according to suited soils
2. A good job on soil preparation
3. Seeding on time
4. Seeding properly
5. Right fertilization
6. Controlled grazing.

Good soil preparation and right fertilization to start the pasture and regular annual fertilization, we think, are the most important factors for success.

Continuation of the pasture program in Alabama for the next 10 years will really make "Grassland Farming" an established practice on most farms.

More and Better Proteins . . .

(*From page* 13)

power to include more of the amino acids on its potential than are possible on the more eastern soils of the Cornbelt? Shall we not expect that State's wheat and alfalfa to represent increasing deficiencies in terms of the specific amino acids and the consequent nutritional deficiencies possibly not yet associated specifically with the shortage of crude proteins but still operating as a hidden hunger?

When our corn and our wheat crops are slipping lower in their creation of proteins in total; when these food essentials are already known to be incomplete in the essential amino acid, tryptophane, for example, in corn, and lysine in the case of wheat; and when those originally more fertile soils produced higher concentrations of proteins in these same grains once upon a time, isn't it high time for us to look at our national protein problem? Shall we not view it as one of soil-fertility exhaustion under two of our most extensively grown grasses, which corn and wheat are? Shall we view our meat problem and our milk problem as merely matters of economics? Shall we not recognize the great natural forces which are responsible for the *bad economics?* Shall we believe that a different kind of agriculture, called grass agriculture, will solve the problem? It ought soon to become clear that the human's struggle for meat, the choice food protein, is merely part and parcel of the struggle by all life for its proteins.

There will be no escape from that struggle by asking our animals to eat grass grown on any soil and to give us the relief from that struggle by their solution of the problem. It is not solved when our farm animals ask the plants on less fertile soil to provide them with protein. The abundance of this nutritional necessity in our crops, in our larger numbers of domestic meat animals, and in the markets for ourselves will become possible, not because we juggle crops or systems of agriculture and economics, but only because we prop up the whole biotic pyramid consisting of microbes, plants, animals, and man by means of the most completely fertile soils as the foundation of it.

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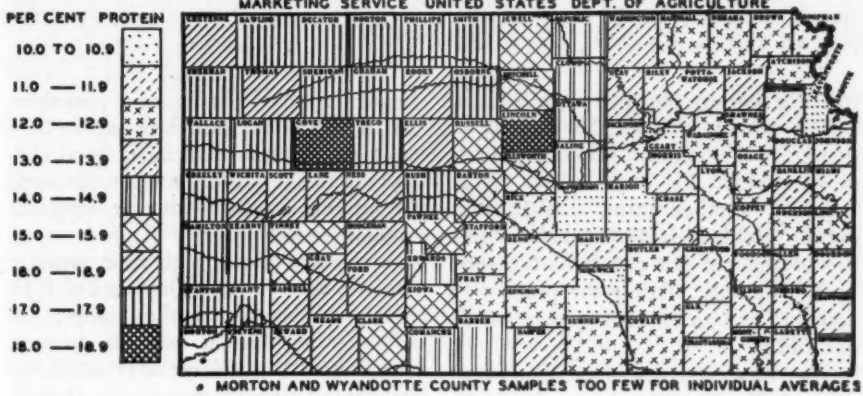
Fig. 1. (See charts on opposite page.) The high protein of wheat is marching westward with our mining of soil fertility. Protein of the germ as creative excuse for the grain remains, but what was extra protein in the endosperm for "hardness" can no longer be grown there to keep "soft" wheat from marching west too.

PROTEIN CONTENT OF WHEAT—KANSAS 1940

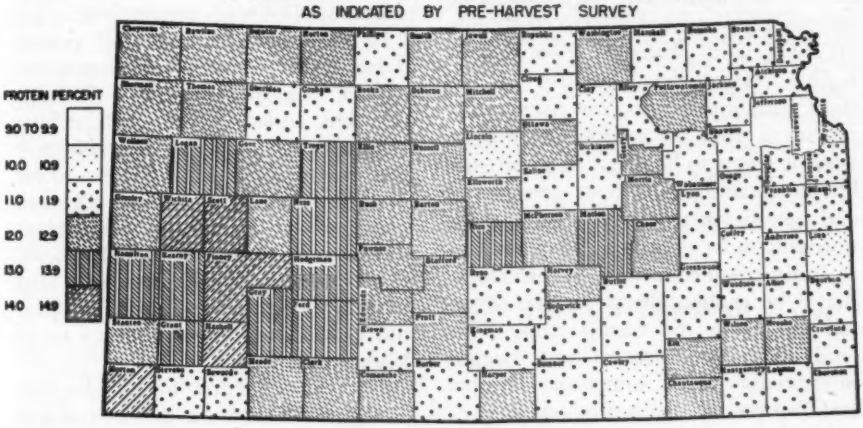
AS INDICATED BY PRE-HARVEST SURVEY CONDUCTED BY AGRICULTURAL MARKETING SERVICE UNITED STATES DEPT. OF AGRICULTURE



* MORTON AND WYANDOTTE COUNTY SAMPLES TOO FEW FOR INDIVIDUAL AVERAGES

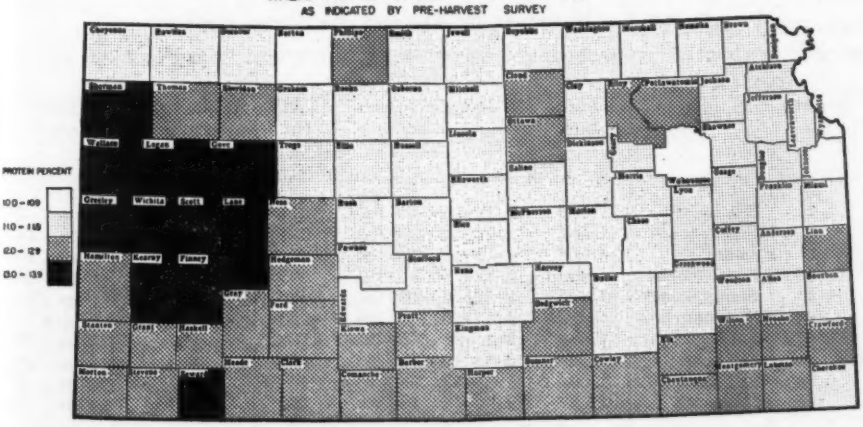
PROTEIN CONTENT OF WHEAT — KANSAS 1949

AS INDICATED BY PRE-HARVEST SURVEY



WHEAT PROTEIN CONTENT — KANSAS 1951

AS INDICATED BY PRE-HARVEST SURVEY



Growing Better Turnips . . .

(*From page* 16)

instance manure plus 200 pounds muriate of potash yielded 858 bushels of turnips, while manure plus 300 pounds of salt yielded 154 bushels less. Similarly on another farm, 2-12-10 plus potash yielded 1,144 bushels, while the addition of salt depressed the yield by 198 bushels. Lately the practice of applying salt to turnips appears to be declining.

The total nutrient requirement of the turnip is not so great as for potatoes or corn. A crop of 1,000 bushels has a nutrient requirement of 100 pounds of nitrogen, 50 to 60 pounds of P_2O_5, and about 125 pounds of K_2O. Nevertheless, because of the short growing season, for turnips are not sown until the middle of June or later, it seems to be essential to provide liberal quantities of both phosphates and potash when soil tests show these nutrients to be deficient. Manure, too, is indispensable, and it is preferable that it be applied liberally to the clover sod preceding the turnip crop. This tends to reduce root rot and maggot infestations which sometimes become troublesome in turnip production.

In almost all turnip-growing areas, brown heart or water-core is prevalent. In the Maritime provinces where acid soils are predominant, fairly good control of this disorder may be obtained by mixing borax with the fertilizer applied to the crop.

However, in the high lime areas of Ontario and Western Quebec, Dr. J. D. MacLachlan, one of the pioneers in investigating brown heart in turnips, determined that foliage applications of borax to prevent water-core (brown heart) development in turnips have been more effective than borax applications applied with the fertilizer. The usual rate of application is 20 pounds of borax (sodium tetraborate) per acre applied as a spray to which a sticker has been added. Generally speaking, spraying the borax on the crop gives greater freedom from brown heart than soil applications even on acid soils. This may be due to the difficulty experienced in mixing the small quantity of borax required with relatively large quantities of fertilizer, while by spraying, each turnip plant is likely to get its required dosage.

Market preferences for turnips have greatly influenced the methods of production. Most consumers want medium

TABLE V.—RESPONSE OF TURNIPS TO EXTRA POTASH

Grower No.	Texture	Drainage	Farmer's own treatment	Yield Bu.	Farmers own plus 200 lbs. (muriate of potash)	Difference
1	Silt loam	Good	2–12– 6 325 lbs.	971	994	Plus 23
2	Sandy loam	Good	2–12–12 200 lbs.	600	748	Plus 148
3	Loam	Good	4– 8–10 300 lbs.	853	970	Plus 117
4	Sandy loam	Good	2–12– 6 300 lbs.	682	924	Plus 242
5	Sandy loam	Good	2–12– 6 300 lbs.	946	1,056	Plus 110
6	Silt loam	Good	4–12–10 300 lbs.	920	916	Minus 4
7	Sandy loam	Good	2–12–10 400 lbs.	792	990	Plus 198
8	Silt loam	Good	5–12–15 500 lbs.	651	895	Plus 244
9	Silt loam	Good	4– 8–10 600 lbs.	728	807	Plus 79
10	Silt loam	Good	4–12–10 600 lbs.	768	854	Plus 86

to small sizes, mostly under two pounds in weight. Thus, growers are thinning to a distance of 6″ to 8″ in the row, and the rows are usually 26″ to 28″ apart. This insures against oversize turnips.

Turnips sold for table use are carefully trimmed, then washed, and when dried are run through liquid wax at a temperature of 250-270° F. This gives a glossy finish with plenty of consumer appeal. The waxing also retards moisture losses and tends to retain the fresh crispness, as well as reduce loss of vitamin C for which the turnip is particularly valuable.

The purple-topped, globe-shaped Laurentian developed by Professor Raymond of Macdonald College, Quebec, holds top billing as the most popular variety, both for the domestic and export market. It has a mild flavour, good quality and appearance, and ships well.

Compared with several other farm crops, turnips have been grown profitably for the past number of years. It is a safe crop to grow as any surplus over market requirements can be fed to livestock. The good turnip grower aims at 1,000 bushels per acre, although yields much higher than this are quite common.

The export market for turnips is on a solid footing since a high standard of uniformity and quality is constantly enforced.

Exports of turnips to the United States date back to around 1880. About this time, a sheep breeder near Guelph, Ontario, was advised by a customer in Boston, Massachusetts, to send plenty of feed along with the shipment of lambs as there was a feed shortage in that area. Mr. Barry, the shipper, put a quantity of turnips in the car, since sheep have a particular liking for them. After their arrival in Boston, it is related that some of the turnips found their way to the tables of Bostonians where they were apparently relished.

Upon this simple and somewhat accidental invasion of the Canadian turnip has grown a full-sized industry, pleasing to the United States customer and profitable to the Canadian farmer.

Fertilizers Used by New York Tomato Growers . . .

(*From page* 8)

practically negligible had one grower, who applied 265,200 pounds of 5-10-5 on 102 acres, used 6-12-6 or 8-16-8 instead of the lower analysis 5-10-5.

Along with higher analyses, the New York Experiment Stations are recommending narrower ratio fertilizers, especially on soils where large amounts of phosphorus have been applied in the past. In Table IV it is evident that considerable progress has been made in this direction. A total of 80.6 per

TABLE IV.—SUMMARY OF FERTILIZER RATIOS USED BY 24 N. Y. TOMATO GROWERS IN 1951

Ratio	Analysis	Pounds used	Per cent of total
1–1–1	10–10–10	45,000	5.0
1–2–1	5–10–5	265,200	29.7
1–2–2	5–10–10, 6–12–12, 8–16–16	409,840	45.9
Misc.	6–18–6, 4–14–6, 4–12–8, 10–6–4	172,700	19.4
	Total	892,740	100.0

cent of the fertilizer used by the 24 tomato growers in 1951 was in the 1-1-1, 1-2-1, and 1-2-2 ratios—the ones ordinarily considered and recommended as narrow, while only 19.4 per cent was in other ratios.

The average analysis for all of the fertilizer used by the 24 growers was 4.9-12.7-7.5, which approximates a 1-2½-1½ ratio. It is obvious that this is considerably closer to the 1-2-2 recommendation than the 1-4-1 and 1-3-1 ratios commonly used 20 years ago.

Study of the fertilizers used by 24 leading tomato growers in 1951 indicates that in many cases nitrogen and potash applications were less than the amounts that should have been used. Considerable progress toward higher analysis and narrower ratio fertilizers has been made by these growers, but because they represent the best in the State and still fall short in their fertilizer practices, it is obvious that all New York tomato growers (and perhaps those in other states, too) should carefully study their fertilizer programs to insure production of maximum yields and profits.

Weed Control . . .

(*From page* 20)

direct assistance. The chemical industries involved have conducted their own research and have kept abreast of the rapidly developing science. As a whole they have kept their recommendations remarkably well in line with the best research findings.

The future of weed control is very promising. It is potentially possible that some day we will have a chemical that will kill all plants other than the crop plant being grown or that it may control any specific weed without injury to other plants.

It's in the Bag . . .

(*From page* 5)

sciously using any of these newly recommended necessities.

Is there apt to be any limit to the list, as long as science expands and investigates new ones? Growth of chickens, for example, is much stimulated by the antibiotics from various molds, phenylarsonic acid, and "surfactants." The element "xanthophyll" quickly intensifies yellow pigments that show up in the legs, skin, beak, and yolk. The surfactants which may possibly operate inside the digestive tract are ruled to be drugs, so their use in chick rations by mixers must be checked with the Food and Drug administrators. The arsenicals make broilers look nicer and more appetizing on the market. Xanthophyll in reasonable amounts has commonly been fed to chickens in yellow corn, corn gluten meal, and alfalfa. And so it goes—with commerce breathing hard on the bent shoulders of laboratory delvers, ready to snatch up and broadcast the latest amazing discovery of something new and supposedly indispensable.

No doubt this parade of dispensers behind the discoverers is far better than to have everybody skeptical and lagging. It's a better climate for progress than we had when Henry, Babcock, Armsby, Pasteur, Koch, and their like started out to blaze new theories of animal growth, production measurement, and disease prevention. The doubt and dismay of farmers over acceptance of those new ideas and methods were never met by industrial and commercial zeal in

defense of them. This was mainly because no sizable block of industry had been fashioned to cater to and supply the needs of farmers. It's different now, with the farm beset with high costs and saddled with expensive investments. The old guess-and-by-gracious system won't save even the toughest of our disappearing rugged individualists. Yet even with this universal background for our agriculture, a man can still avoid glittering pitfalls and be wary about accepting and adopting anything just because it's new. It must be "new plus" before it is worthy of farm practice.

For a long time feeders knew that most species of farm animals thrived in a gorgeous way when their rations contained some meat scraps, digester tankage, fish meal, fish solubles, dairy by-products, and such things which came from other animal sources. Of course, these animal ingredients had to be balanced with grains and forages. Just what "complex" there was in animal by-products which did this so much better than plant products was unknown. Finally since 1948 it has been amply proven that this constituent which made animal by-products so superior was mostly Vitamin B_{12}. Having found what caused this favorable reaction in feeding animal by-products, our top-notchers tried hard to match it somehow in plant residues. But they have since done even better. They have traced it to the microorganisms that come from industrial fermentation and the antibiotics such as medical science uses so well. Little sign of Vitamin B_{12} has as yet been found in plant materials.

As late as 1950 it was determined that adding pure aureomycin to a chick starter made the chicks grow much faster. More such reports have been dug out to verify the use of certain antibiotics in feeding both swine and poultry. Now it is known that a teaspoonful of some of these powerful antibiotics mixed into a whole ton of feed is enough to start a "chain reaction" in the pile.

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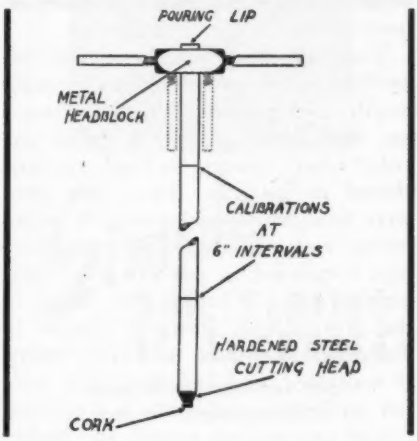

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I am told that hog and chick growth caused by these antibiotics stems from their sanitary and curative properties inside the animal's intestines. That's all to the good. If it proves true, we may see a quick end to those ghastly old seminars in the farmers' week programs where the professors handled yards of chicken inwards during post-mortem lectures. The post offices may also be shut of those cardboard shoe boxes of reeking animal specimens en route to the college laboratory.

There are other queer angles to this antibiotic business as it affects livestock health and growth. An experiment has been mentioned by a noted specialist where healthy, well-fed pigs purchased on a clean, disease-free farm were brought in and intensively fed on rations with aureomycin. None of these pigs responded to any extent in their growth gains. On the other hand, at the Agricultural Research Center in Beltsville, Maryland, unthrifty, runty, ill-nourished, and unkempt pigs were fed antibiotics and made a surprising rate of gain in their growth and health.

Carrying this further, some English feeders found this year that the same effects secured by feeding antibiotics were obtained by keeping chickens isolated in new, sanitary quarters where no poultry had ever been housed. Repeating this same procedure, the Beltsville feeders found that chicks without antibiotics kept in new houses grew just as fast or faster than those fed antibiotics in the old quarters. This seems to show that antibiotics make animals grow faster because they retard the development of harmful organisms in the digestive tract.

You can't carry this system out in ordinary practice by providing new quarters for every batch of chicks, so feeding of antibiotics should be a partial solution to the sanitary question—always with some possible limits.

In all these new findings, we rely finally upon the results which an ordinary farmer can get from his hogs and chickens, rather than to depend solely upon the controlled tests that the colleges and industrial scientists report. Advertising and native curiosity join here in getting farm feeders to do a little experimenting on their own, out where there are flies, insects, worms, filth, and all other practical obstacles that provide a real rugged trial for the dope in question.

Your smart farm journalist hikes right out there to the dirt farmer for his main story. What has been his experience? And most of the keen advertising gentry do likewise, using pictures of Farmer Meadowcraft pointing with pride at something besides an election year promise.

It has now been fairly well established in farm feeding tests that if growth is stimulated well the livestock will more rapidly part company with the boss and be sent to the shambles. Sometimes it happens that quick maturity brings a better market price too, and always saves some labor and expense. Beyond this there are yet some tests to be made on what effects can be expected from antibiotics in relation to the grade and quality of the hog carcass and, in a quiet, unobtrusive way, what effect it will have on consumers who eat pork chops impregnated with the residues of these medicinal agents.

To date, the experts affirm that antibiotics cannot ordinarily be fed in amounts likely to be dangerous or poisonous to consumers. The amounts thus added to the recommended ration are usually much less than antibiotics which are fed for the treatment of disease. Label requirements also tend to keep the feed mixing well within the regulations imposed by feed control officers.

Because houseflies and mosquitoes have been defending their lives against DDT by resistance building, the thought has bobbed up in feeding circles that maybe internal parasites and harmful bacteria in animals might get the same idea and start getting resistant to certain antibiotics in the feed bag.

As long as medical science can keep on finding molds and ferments of varied value, this fear is largely useless. It would be possible to switch around from one antibiotic to another and thus fool the bacteria that think they have perfected a resistant scheme. All of which shows us how far we have gone from the old days, when you just kept on using the same process and the same mixture or method regardless, mainly because it was "good enough for Dad." I am not sure whether the bacteria we were raised with could keep step with the modern world like their offspring. If they have become alert and watchful, we humans cannot afford to take any chances.

This brings me down to rock bottom again. In all our fervid search for relief and aid from science, it is not feasible for us to imagine that we can make a wonder feed out of what used to be classed as a poor one. That is, we cannot make nothing into something. There is no magic in the world that will enable us to stir in some dope and transform a coarse and unpalatable ration into one that brings home the bacon.

In turn, this fetches us to another conclusion. Too much stress has been put on short cuts and panaceas, to one branch of farming against the whole picture. My idea is that sound farm management as a whole is what pays. Not just dabbling on side lines or portions of the farming enterprise.

You and I have known farmers who specialized too much on one line and neglected the outcome of the entire picture. To be sure, it's mighty valuable to be a good feeder, but other skills galore are vitally necessary on the modern farm, even on a specialized pork or poultry farm. I doubt if there are any occupations today that demand as many-sided abilities as that of agriculture.

Hence we all know that it takes a lot of experience and preparation before a farmer can be sure that the outcome of his efforts is actually "in the bag."

NO_3 Ca
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pH *Method gives* CO_3
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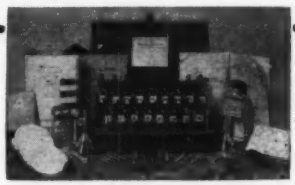
Mg *—for less—* Cl
Na Mn
Al



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A proud father, one Sunday, was showing off his children and proceeded to ask one of his little boys, in the presence of a grandfather: "What is matrimony?"

The little boy's eyes bulged out at the suddenness with which the question was put, and then he said mechanically:

"Matrimony is a state of punishment to which some souls are condemned to suffer for a while before they are considered good enough to go to Heaven."

"Wait a minute," said the father. "That's the definition of purgatory."

"Let him alone," said the grandfather. "He may be right—he may be right."

* * *

Soldier: "If I told you that you had a beautiful figure, would you hold it against me?!"

* * *

Two taciturn Maine farmers met each other every day for 30 years in the village store without exchanging one word. One day Farmer Slocum turned left when he went out instead of turning right. "Where ya going?" asked his startled neighbor. "None of your durn business," snapped Slocum, "and I wouldn't tell ye that much if we warn't old friends."

* * *

It was the first day of school. The teacher was explaining that if anyone had to go to the washroom they should hold up two fingers. One little boy looked puzzled and finally asked: "How's that gonna help?"

A bee's sting is one thirty-second of an inch long. The other two feet are imagination.

* * *

Man walking down street is stopped by a panhandler who begs the price of a cup of coffee.

"Come! Come!" says the man. "Let's be honest about this, at least. What you mean is: Will I give you the price of a drink? Come with me."

Man takes panhandler by the arm, walks with him four or five doors to nearest bar, leads him in. Our hero, leaning against bar, says to bartender, "Bring two double bourbons, plain water chasers."

Says the panhandler, "Make mine the same."

* * *

Child Training Expert—"If your children become unmanageable, quickly switch their attention."

Puzzled Parent—"Switch their what?"

* * *

Said the artist: "I'll give you five dollars if you'll let me paint you."

The old mountaineer shifted his tobacco from one cheek to the other and back again.

"It's easy money," said the artist.

"Thar hain't no question 'bout thet," the mountaineer replied. "I was just a-wonderin' how I'd get the paint off afterwards."

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